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(71) Applicant

Schomaker Buchbinde GmbH & Co. KG,

(Incorporated in FR Germany),

Elsternweg 12, D-5750 Menden 1, Federal Republic of Germany

(72) Inventor

Josef Dick

(74) Agent and/or Address for Service

Page White & Farrer, 5 Plough Place, New Fetter Lane, London EC4A 1HY

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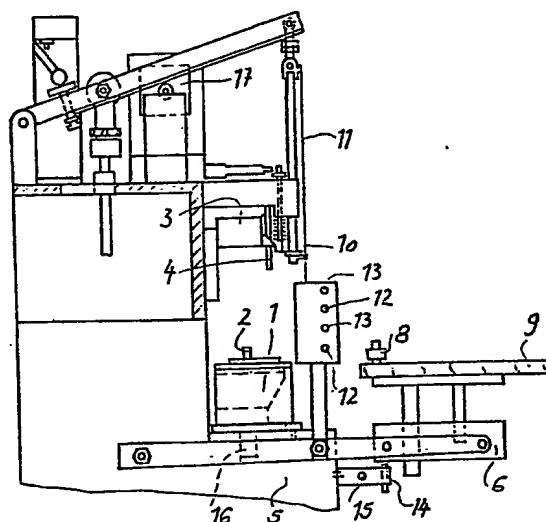
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Selected US specifications from IPC sub-class F16P

(54) Apparatus for monitoring and controlling index cutting machines for cutting finger notch indexes in books

(57) In an apparatus for monitoring and controlling index cutting machines for cutting finger notch indexes in books or the like, which consists of a fixed bottom cutter 2 a top cutter 4 movable vertically, a horizontally movable holder 9 for the book 7 enabling the edge in which the index is to be cut to be correctly positioned between the bottom and top cutters, and a finger guard 10, the vertical movability of the top cutter being controlled by a sensor 12, 13 which determines whether the cutting area is free from objects, it is proposed, for the purpose of ensuring that the monitored gap above fixed cutter 2 is adjusted according to the increase of the thickness of the book, that a magazine of sensors 12, 13 be disposed with vertical spacing of finger gap width (about 10 mm) and be coupled to other sensors 14, which sense the horizontal feed of the book, in such a manner that at a book thickness which reaches a first lowermost sensor (12, 13), and which corresponds to the finger gap width spacing, a first sensor (14) sensing the horizontal feed deactivates said first sensor (12, 13), and that the other adjusted sensors (12, 13; 14) control similar operations in dependence on the height and feed of the book.

Fig. 2



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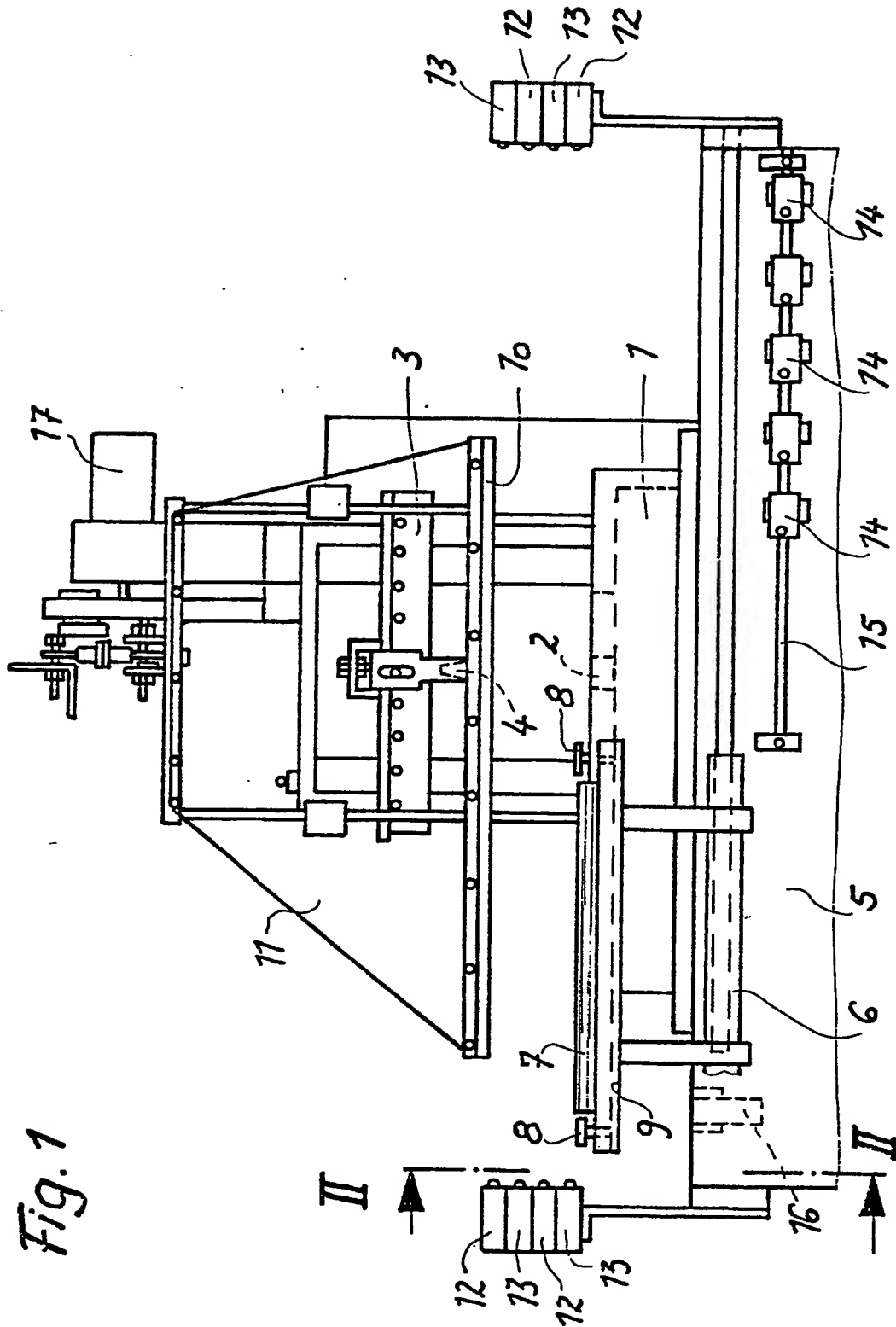


Fig. 2

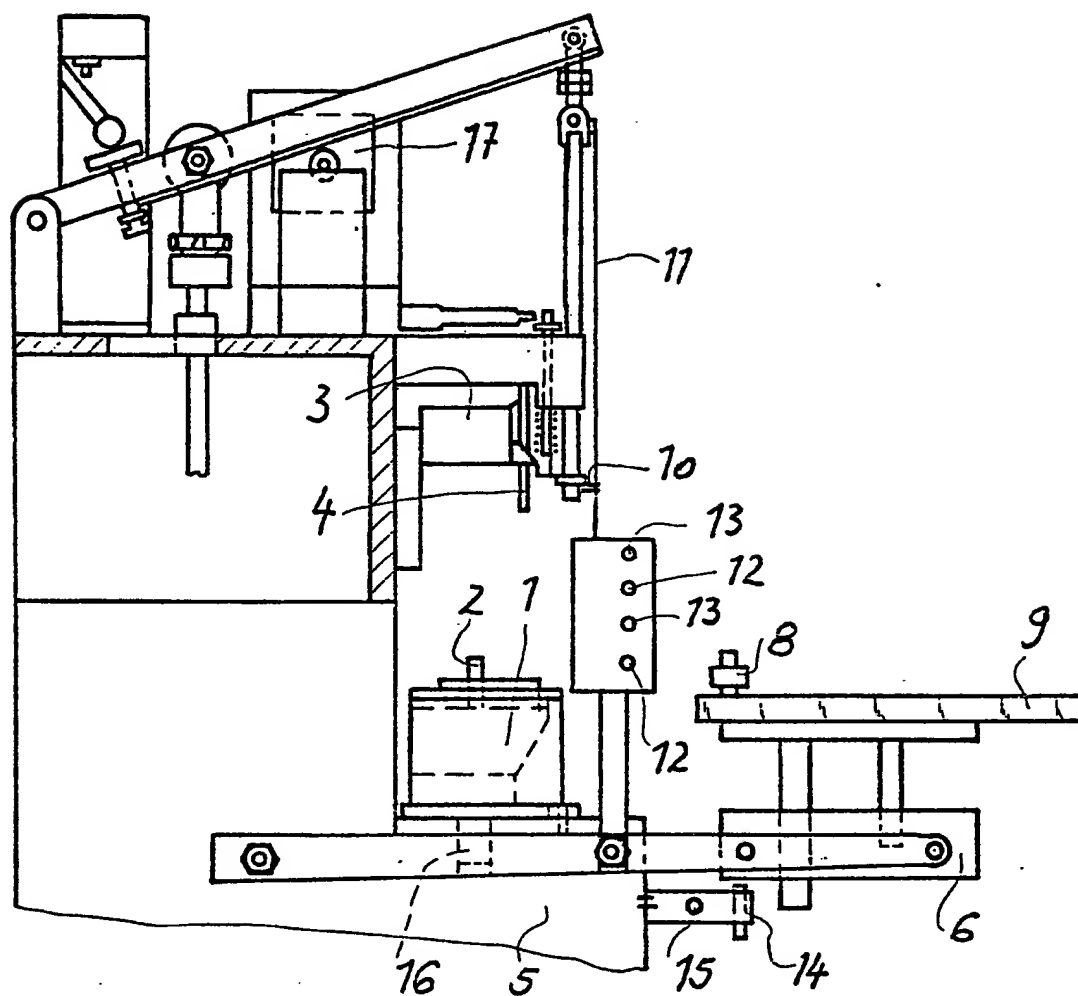


Fig. 3

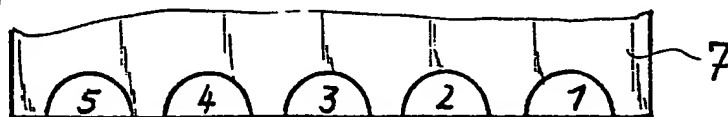


Fig. 4

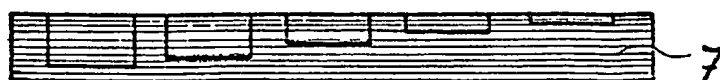
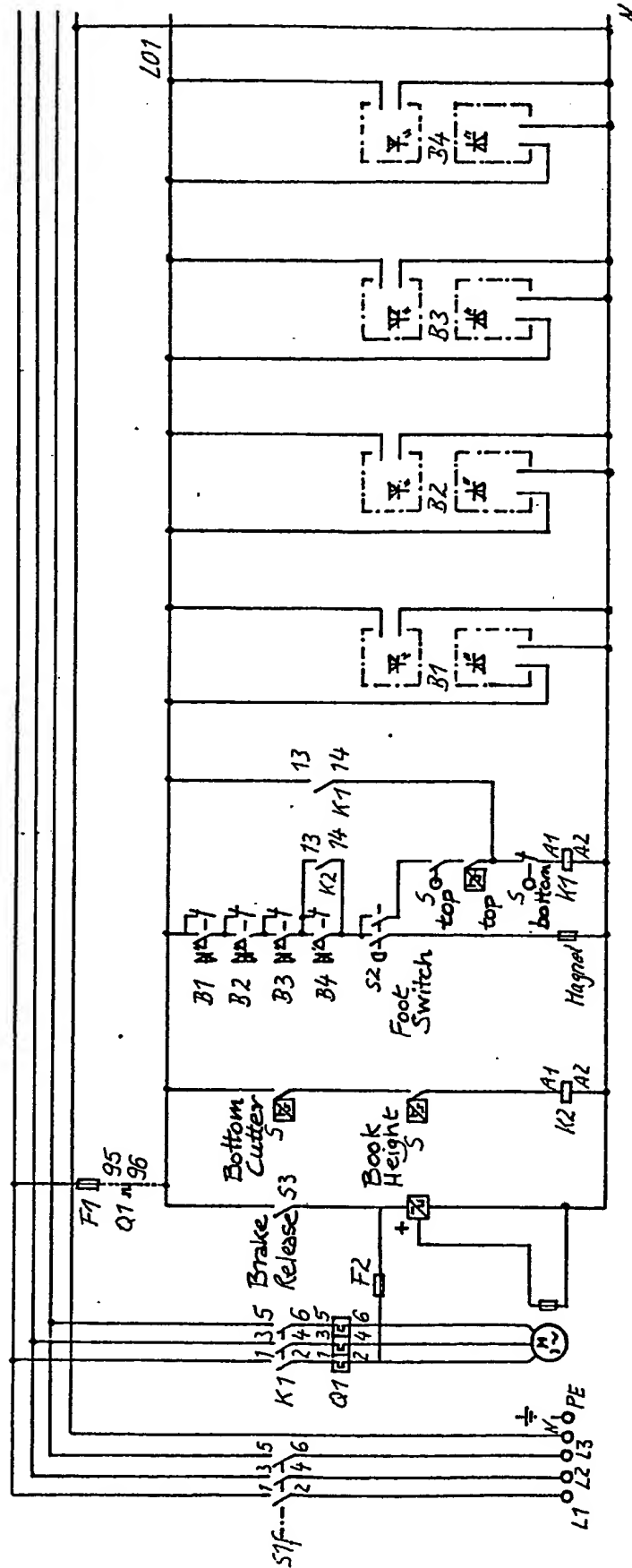


Fig. 5



SPECIFICATION

Apparatus for monitoring and controlling index cutting machines for cutting finger notch indexes in books

The invention relates to an apparatus for monitoring and controlling index cutting machines for cutting finger notch indexes in books or the like, which consists of a bottom cutter fastened to the machine frame, a top cutter movable vertically towards and away from said bottom cutter, a horizontally movable holder for the book enabling the edge in which the index is to be cut to be correctly positioned between the bottom and top cutters, and a finger guard, the vertical movability of the top cutter being controlled by a sensor, which determines whether the cutting area is free from objects, for example the operator's fingers, in such a manner that a vertical cutting movement is possible only when the sensor signals "cutting area clear", at least in an area of finger gap height, namely about 10 mm in height.

Devices for cutting indexes on the edges of books, catalogues, or similar printed matter are known in the prior art.

For normal index cutting each corresponding part of the longitudinal edge of the book or the like is completely moved away, in the longitudinal direction of the edge, as far as the selected index cut. The height of the book portion which is to be cut is in this case limited to maximum heights of up to 10 mm. This limit is imposed in order to prevent injury to the operator's fingers. A finger guard is in fact automatically lowered under constrained control to its end position about 10 mm above the top edge of the bottom cutter. Only when this finger guard has been completely lowered can the top cutter of the cutting tool be lowered by the action of a motor and the cutting operation be carried out.

In this arrangement it is customary for optoelectronic sensors, for example light barriers, to be disposed in front of the finger guard (viewed from the operator's position), such light barriers preventing, through appropriate electric circuitry, the lowering of the finger guard as long as the light barrier is masked by fingers or the like. In this case the light barrier is also disposed and aligned about 10 mm above the top edge of the bottom cutter. For normal index cutting the book portions which have been cut are swung away in the downward direction, so that no book heights of more than 10 mm requiring cutting can or can be allowed to occur.

In the case of index cutting machines for cutting finger notch indexes according to the present invention this method of working is not possible. On the contrary, for finger notch registers it is necessary to leave the book below the finger guard to its full height, which increases as the cutting operations proceed, since for all index cuts after the first it is necessary for all the edges of the book lying therebeneath to be cut through at the required point. Because of this requirement in the case of finger notch indexes, the safety arrangements and the constrained electric coupling of the finger guard and the light barrier are not possible in the same way as for

normal indexes.

On the basis of these considerations, the problem underlying the invention is that of providing an apparatus of the kind first defined above, in which it is ensured that within a finger protection area above the book portion which is to be cut in each individual case a free space of about 10 mm is monitored to determine that it is free from fingers or other objects and that the cutting operation can be carried out only when the finger gap is clear.

For the purpose of solving this problem the invention purposes that a magazine of sensors disposed vertically one above the other, and sensing the height of the book near the cutting region, should be disposed with vertical spacing of finger gap width (about 10 mm), and should be coupled to other sensors, which sense the horizontal feed of the book, in such a manner that at a book thickness which reaches a first vertically disposed sensor, and which corresponds to the finger gap width spacing, a first sensor sensing the horizontal feed deactivates said first vertically disposed sensor, and that the other adjusted sensors control similar operations in dependence on the height and the feed of the book.

The particular problem solved by the invention is the fact that the reference distance for the finger protection area continually varies, that is to say increases, as the cutting of the finger notch index progresses, so that the reference measurement determining the finger protection area is not a value fixed for the machine but the relative height of the particular book portion lying in the cutting region.

The arrangement according to the invention, in which sensors sensing the varying height of the book in steps of about 10 mm are disposed vertically one above the other, enables the finger protection area at any particular moment to be sensed. Through the coupling of these sensors to sensors which sense the horizontal feed of the book or book holder, it is ensured that the lowermost vertical sensor at a given moment will be put out of action when the horizontal book feed has reached the value adjusted to the safety range.

The apparatus according to the invention is explained more fully below with the aid of an example.

Before commencement of the cutting of an index the sensors sensing the horizontal feed are first adjusted in such a manner that the sensor associated with the first vertical sensor will deactivate the first vertical sensor, that is to say will put it out of action, when the horizontal feed has covered a distance corresponding to a book thickness in the punching range of 10 mm. The second vertical sensor is disposed at a distance from the first vertical sensor which corresponds to the finger protection height, that is to say about 10 mm. The second sensor sensing the horizontal feed is in turn disposed at a distance from the first sensor on the feed path such that said sensor is switched by the feed of the book or its holder when the thickness of the book reaches 20 mm. The other vertical sensors and the sensors sensing the horizontal feed path are disposed with corresponding relative spacing.

If it is now desired to provide a book with finger notch indexes, the relatively thin first book portion is

first placed with its edge between the top and bottom cutters, and the corresponding finger notch is cut. The book is then moved horizontally, its edge remaining parallel to the cutting edges of the top and bottom cutters, the next pages of the book are turned over, so that the relative thickness of the book in this cutting region is increased, and the second finger notch cut is made.

As soon as the thickness of the book reaches about 10 mm, the first vertical sensor is switched and the machine would then *per se* be locked. However, owing to the fact that the first sensor sensing the horizontal feed is simultaneously switched, the first vertical sensor is deactivated, that is to say put out of action, so that only the sensors following the first vertical sensor remain capable of operating.

In accordance with the further cutting of the index, the increase in the thickness of the book, and the further feeding of the book in the horizontal direction, the next vertical sensor is reached after a further increase of the thickness of the book by 10 mm, and at the same time the second sensor sensing the horizontal feed is also operated, so that the second vertical sensor is put out of action. The number of the series of additional vertical and horizontal sensors is adapted to the thickness of the book.

The invention proposes that for preference the magazine of sensors sensing the height of the book should consist of a plurality of series connected light barriers (transmitters and receivers).

At the same time it is also preferable for the transmitters and receivers of the light barriers of the magazine to be disposed alternately on the right and on the left of the path being sensed.

In this way it is ensured that the respective neighbouring light barrier transmitter or receivers do not interfere with one another.

In addition, it is preferable for the sensors sensing the feed of the book to be in the form of proximity switches.

It is moreover preferred that the holder used for the book should in a manner known *per se* be a movable table of a material acting on magnetic fields, and that the sensors sensing the feed of the book should be in the form of inductive proximity switches sensing the front edge of the table, referring to the direction of feeding.

Proximity switches of this kind have the advantage that they cannot be operated by residues of paper or the like, but only by the movable table, which for example is made of steel.

In order to facilitate the adjustment of the spacing of the sensors, it is proposed that the sensors sensing the feed should be adapted to move and to be secured in position on a guide fixed parallel to the feed path.

In order to ensure that the apparatus will be able to function only if the holder carrying the bottom cutter is disposed in the correct position, it is proposed that the bottom cutter should be mounted on a holder adapted to be connected to the machine frame, and that a switch which closes the circuit for the sensors when the holder is in position should be provided on the machine frame.

As a special feature it may be observed in this con-

nection that it is customary for the same machines to be used for normal indexes and for finger notch indexes. The holders carrying the bottom cutter and the corresponding top cutters are then simply changed. Since the holder for the finger notch index is considerably shorter than that provided for normal indexes, an inductive proximity switch is mounted flush in the lower frame of the machine and will be covered when a holder for normal index cutting is installed, so that the circuit intended for finger notch indexing is disconnected, although this circuit will be freed on the installation of the holder required for the finger notch index and will not be covered by parts of the holder, and the switch will then close the safety circuit for the safety unit described in detail above.

One example of embodiment of the invention is explained more fully below with reference to the drawings, in which:

Figure 1 is a front elevation of an apparatus according to the invention;

Figure 2 is a side view thereof;

Figures 3 and 4 are respectively a plan view and a front view of a finger notch index;

Figure 5 is a basic circuit diagram of the safety control system in the apparatus according to the invention.

The apparatus for monitoring and controlling index cutting machines for cutting finger notch indexes in books, catalogues, or similar printed matter consists essentially of a bottom cutter 2 carried and fastened to the machine frame by a holder 1, a top cutter 4 movable vertically towards and away from said bottom cutter and held on a cutter carrier 3, and of a holder 6 horizontally movable on the machine frame 5 and serving as carrier for the printed matter which is to be processed and which is indicated at 7.

The printed matter can be fastened by means of clamp devices 8 on the table 9 of the holder 6. In addition, a lowerable finger guard 10, together with a transparent curtain-like cover 11, is disposed in front of the cutters 2 and 4, as viewed from the operator's position. An electric circuit arrangement is provided which ensures that the lowering of the top cutter 4 and cutter carrier 3 by means of a motor can be effected only when the gap between the top edge of the bottom cutter 2 and the surface of the portion of the book or printed matter which is to be cut is free from fingers or other objects.

This safety device consists essentially of a magazine of sensors which are disposed one above the other and which in the illustrated example are in the form of light barriers comprising a transmitter 12 and a receiver 13, which form a vertical light barrier plane between the cutters 2, 4 and the table 9. These sensors sense the height of the book, which continuously increases in steps as the cutting of the index proceeds, at a point near the cutting region, or more precisely in vertical steps of finger gap width of about 10 mm.

In addition, at least one sensor, but preferably a plurality of sensors, is or are provided, which in the illustrated example are inductive proximity switches 14 and which sense the horizontal feeding of the book during the cutting of the index, either directly or indirectly by sensing the holder 6 or the table 9.

In this arrangement a first proximity switch is disposed in such a manner that it is operated by parts of the holder 6 as soon as the latter has advanced a corresponding distance, the latter being so adjusted that when switching occurs a book thickness of about 10 mm has been reached in the region of the index cut.

In this condition the lowermost light barrier 12, 13 is covered by one or more pages of the book, so that the operation of index cutting would *per se* be interrupted. Since, however, in this position the proximity switch corresponding to the first light barrier 14 is switched on, corresponding circuitry action deactivates the lowermost light barrier 12, 13, that is to say puts it out of action. Only the other light barriers situated thereabove, namely three such light barriers in the illustrated example, still remain in operation. As the cutting of the index in the book progresses and the holder 6 is correspondingly advanced, the second light barrier (counting from the bottom) is masked and thus the operation is *per se* interrupted, while however this light barrier has associated with it another proximity switch 14 at a greater horizontal distance from the starting position of the holder 6, and this switch deactivates the corresponding second light barrier and thus enables the apparatus to continue to function. Each other light barrier has associated with it a respective additional proximity switch. In this way it is possible for finger notch indexes to be cut continuously with continuously increasing book thickness while nevertheless complying with safety requirements, since a light barrier is in each case operative directly above the portion of the printed matter which is to be cut and puts the apparatus or the machine out of action if the light barrier is interrupted by the insertion of fingers or the like.

The proximity switches 14 are arranged to be movable and fixable on a guide 15 mounted parallel to the feed path of the holder 6.

The holder 1 carrying the bottom cutter is connected to the machine frame 5 in the illustrated example, while on the machine frame an inductive proximity switch 16 is fastened, this switch being incorporated as a normally closed switch in the circuit of the apparatus and interrupting said circuit when the proximity switch 16 is masked by parts of a holder or the like.

In the illustrated example of embodiment the proximity switch is not covered by parts of the holder 1, so that in accordance with the switch function the circuit of the apparatus is closed. This proximity switch is adapted, as its principal function, to be covered when a holder for normal index cutting, corresponding roughly to the holder 1, is fitted, because the holder for normal index cutting is considerably longer than that for finger notch cutting. When therefore the other holder is fastened on the machine frame 5, the switch 16 breaks the safety monitoring circuit. An alternative monitoring circuit for normal index cutting is then closed, this circuit not forming part of the present invention.

In order to ensure that cutting will be possible by means of the top cutter 4 and bottom cutter 2 only when the finger guard 10 has been lowered, the fin-

ger guard 10 can be coupled to a series of sensors, the first of which is activated only when all the vertical sensors 12, 13 are operative, in which case all the other sensors of this series are deactivated. The second sensor of this series of sensors is activated on the deactivation of the first vertical sensor, in which case all the other sensors of said series are inoperative. The following sensors of the series are similarly interlinked with the vertical sensors. The sensors thus sense the position of the finger guard at each particular moment in relation to the portion of the printed matter which is to be cut, and free the circuit for the cutting tool only when the finger guard is resting on said portion, in each case within an area of finger gap width, namely a height of about 10 mm.

The finger guard is lowered with the aid of a magnet 17, which holds the finger guard in the top end position and which is released on operation of a foot switch if, on the operation of the latter, the light barriers 12, 13 are free from inserted fingers or the like. As soon as the magnetic switch 17 is released, the top cutter 4 can also be lowered by means of the associated motor drive and the finger notch cut for the index can be made in the appropriate position. With apparatus of this kind it is customary for the finger guard first to be returned to the top end position after a cutting stroke has been made and before a new cutting stroke is possible through the operation of the corresponding switch, for example a foot switch. The position in question can be sensed by means of a limit switch.

This, however, is the customary state of the art.

In Figures 3 and 4 a finger notch index is shown by way of illustration. The circuit arrangement is shown in Figure 5 in the form of an example. After the main switch S1 has been switched on, the foot switch S2 releases the magnet holding the finger guard if the light barrier safety circuit has operated.

After the finger guard has been lowered, which is possible only if no object (finger) lies between the light barriers, that is to say under the finger guard, the switch "S top" is closed. This is ensured by an initiator "S top". By means of a limit switch "S bottom", which is in the closed state, the contactor K1 is thereby pulled up. The latter in turn holds itself on with the aid of a normally open contact, so that the motor M is put into operation. The motor drives the top cutter and moves it in the direction of the bottom cutter. After the index cut has been made, K1 is switched off by means of the limit switch "S bottom". During adjustment, manual brake release is possible via S3. After the main switch S1 has been switched on, the light barriers B1 to B4 are made ready. This brings about the enforced switching-over of the two-way contacts, whereby it is ensured that the light barriers B1 to B4 are in the intact state.

If a light barrier should be in a defective state (transmitter or receiver), this switching-over is not possible, so that self-monitoring takes place. If there is no interruption of a light barrier, for example by a finger, the light barrier safety circuit is released. For finger notch cutting K2 is pulled up by the initiator S "bottom cutter" and, when a certain height is reached, switch S "book height". K2 bridges vertically light barrier B4, that is to say the lowermost light bar-

rier. Because of the increase of the height of the book, the light barrier B3 is then compulsorily brought into action as finger protection means.

Owing to the fact that the light barrier also locks the magnet for the lowering of the finger guard if the light barrier is interrupted, the finger guard also cannot be lowered onto any fingers which may be in the path of movement of the finger guard, which would be painful for the operator.

10 Additionally to the light barriers mentioned above and to the top limit switch, inductive proximity switches are also provided. One is in the form of a normally closed switch and is inserted flush in the bottom frame of the machine, so that it is covered by the outermost left-hand side of the normal bottom cutter holder for normal index cutting. When the bottom cutter holder required for finger notch index cutting is installed, this switch will not be covered so that it can then switch and free the safety circuit for the finger notch index. In series with it at least one other proximity switch is mounted on the machine in such a manner that it senses the table moving towards the right but, in the left-hand starting position of the table, cannot yet switch. This switch is mounted on the index cutting machine for lateral movement over the maximum distance required. During the adjustment of the machine the last-mentioned proximity switch is brought into the outermost right-hand position and the machine is adjusted for the cutting. The book to be cut is clamped in position and cut until it has increased to 10 mm. The lowermost light barrier then stops the machine and the proximity switch is thereupon pushed under the book holder and locked in position in such a manner that the light barrier just switches on again. Further cutting to a book thickness of 20 mm is then possible, whereupon the next light barrier is masked. It can then have associated with it another proximity switch so arranged that it senses the book holder and bridges over said light barrier, so that the latter again just switches. Further cutting is then possible until the next light barrier is reached. The process continues in the same way.

If the book holder is moved back to the left in order to unclamp the book, the proximity switches are freed and return all the light barriers to the starting position. In this way different book heights can be sensed with a corresponding number of switches and light barriers. This protection prevents to the greatest possible extent any injury caused by the cutter during the running of the machine.

The invention is not restricted to the example of embodiment described, but can be varied in many respects within the scope of the disclosure.

55 All new individual and combination features disclosed in the description and/or the drawings are to be regarded as essential parts of the invention.

CLAIMS

60 1. Apparatus for monitoring and controlling index cutting machines for cutting finger notch indexes in books or the like, which consists of a bottom cutter fastened to the machine frame, a top cutter movable vertically towards and away from said

bottom cutter, a horizontally movable holder for the book enabling the edge in which the index is to be cut to be correctly positioned between the bottom and top cutters, and a finger guard, the vertical movability of the top cutter being controlled by a sensor, which determines whether the cutting area is free from objects, for example the operator's fingers, in such a manner that a vertical cutting movement is possible only when the sensor signals "cutting area clear", at least in an area of finger gap height, namely about 10 mm in height, characterized in that a magazine of sensors (for example 12, 13) disposed vertically one above the other, and sensing the height of the book near the cutting region, is disposed with vertical spacing of finger gap width (about 10 mm) and coupled to other sensors (for example 14), which sense the horizontal feed of the book, in such a manner that at a book thickness which reaches a first vertically disposed sensor (12, 13), and which corresponds to the finger gap width spacing, a first sensor (14) sensing the horizontal feed deactivates said first vertically disposed sensor (12, 13), and that the other adjusted sensors (12, 13; 14) control similar operations in dependence on the height and feed of the book.

2. Apparatus according to Claim 1, characterized in that the magazine of sensors (12, 13) sensing the height of the book consists of a plurality of light barriers (transmitters and receivers) connected in series.

3. Apparatus according to Claim 2, characterized in that the transmitters (12) and receivers (13) of the light barriers of the magazines are disposed alternately on the right and on the left of the path which is to be sensed.

4. Apparatus according to one of Claims 1 to 3, characterized in that the sensors (14) sensing the feed of the book are in the form of proximity switches.

5. Apparatus according to one of Claims 1 to 4, characterized in that the holder for the book is, in a manner known *per se*, a movable table (6, 9) of a material acting on magnetic fields, and that the sensors (14) sensing the feed of the book are in the form of inductive proximity switches sensing the front edge (referring to the feed direction) of the table.

6. Apparatus according to one of Claims 1 to 5, characterized in that the sensors (14) sensing the feed are adapted to be moved and to be secured in position on a guide (15) mounted parallel to the feed path.

7. Apparatus according to one of Claims 1 to 6, characterized in that the bottom cutter (2) is mounted on a holder (1) adapted to be connected to the machine frame (5), and that on the machine frame (5) a switch (16) is mounted which closes the circuit for the sensors.

8. Apparatus according to one of Claims 1 to 7, characterized in that the finger guard (10) is coupled to a series of sensors, the first of which is activated when all the vertical sensors (12, 13) are operative, while the others of said series are then deactivated, and the second of which is activated on the deactivation of the first vertical sensor (12, 13) while all the other sensors of said series are inoperative, the fol-

lowing sensors of said series being similarly inter-linked to the vertical sensors (12, 13), said sensors detecting the position of the finger guard (10) at any given moment in relation to the book portion to be
5 cut and freeing the circuit for the cutting tool (4) only when the finger guard (10) rests on said book portion.

9. Apparatus for monitoring and controlling index cutting machines for cutting finger notch in-
10 dexes in books or the like, substantially as described herein with reference to the accompanying drawings.

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